

S/N 09/338,045
Docket: GB919980092US1

REMARKS

Claims 31, 32, and 38-42 are all the claims pending in the present Application. Claims 31 and 32 are allowed. Applicant gratefully acknowledges the Examiner's indication that claim 41 would be allowable if rewritten in independent format. However, after reviewing the newly-cited reference, Applicant submits that the rejection currently of record fails to heed the plain meaning of the claim language. Therefore, Applicant declines to rewrite this claim in independent format at this time, since it is believed that all claims are allowable when properly understood in view of the plain meaning of the claim language.

It is noted that, notwithstanding any claim amendments made herein or later, Applicant's intent is to encompass equivalents of all claim elements, even if amended herein or later during prosecution.

The rejection currently of record states that claims 38-40 and 42 are rejected under 35 USC §103(a) as unpatentable over US Patent 6,314,436 to Ungar, further in view of "Uniprocessor Garbage Collection Techniques" by P.R. Wilson. For purpose of the following response, it is presumed that the Examiner intends the patent number to be 5,920,876, rather than 6,314,436.

This rejection based on Ungar is traversed in view of the discussion below.

I. THE CLAIMED INVENTION

As described and claimed herein, for example, by claim 38, the present invention is directed to a method of garbage collecting memory, the memory having objects that have object pointer structures references in a thread stack. An object pointer structure from the thread stack is retrieved.

From the object pointer structure are extracted a reference to its corresponding object and a reference to a next object pointer structure in the thread stack. The retrieval and extraction is then performed for a next, subsequent and last object pointer structures. The thus retrieved object references identify a root set of objects within the memory. The memory not used by the root set of objects is then reclaimed.

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The present invention, by incorporating a memory data structure having a built-in link component to the next memory data structure allows the active memory data structures to be positively identified very quickly, without conducting the scanning operation of conventional techniques.

II. THE PRIOR ART REJECTION

The Examiner alleges that claims 38-40 and 42 are unpatentable over Ungar, further in view of Wilson.

Applicant respectfully disagrees, since the Examiner's interpretation is constrained by the plain meaning of the language of the claims, as that language would be interpreted by one of ordinary skill in the art.

That is, as best understood, the Examiner views the description in Ungar in the Abstract, at lines 8-45 of column 9, line 31 of column 12 through line 28 of column 13, and lines 30-59 of column 20, and Figure 7a as corresponding to the description in claim 38.

Applicant respectfully disagrees.

First, it is not understood exactly which structure in the Abstract the Examiner is considering as corresponding to "... retrieving an object pointer structure from the thread stack". As best understood, the Examiner is presumably relying upon the description in the Abstract: "... a bitmap for each object that indicates which variables in the object are pointer variables and which variables are non-pointer variables. A garbage collection process examines the bitmap, and on the basis of the pattern contained in the bitmap jumps to a particular routine that is tailored to garbage collect the particular routine that is tailored to garbage collect the particular pattern of pointer and non-pointer values in the object."

Clearly, to one of ordinary skill in the art, the Abstract of Ungar makes no reference to a thread stack, let alone object pointer structures in such thread stack. It is submitted that the Examiner is clearly incorrect in alleging that the Abstract retrieves an object pointer from a thread stack, as nowhere in the Abstract is there reasonably any reference to a thread stack. This is a term of art and the Examiner is bound to honor the meaning normally attributed to this term by one of ordinary skill in the art.

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Further, the bitmap mentioned in the Abstract does not function in any way like linked object pointers in a stack. Moreover, it is difficult to understand how one would be able to extract, from a bitmap, a reference to another bitmap. If the Examiner is implying that the bitmap equates to a collection of object pointer structures, then nowhere in Ungar is it described that any object pointers in the bitmap are linked to each other in the bitmap.

Similarly, relative to the Examiner's analysis of the claim limitation "... extracting, from the object pointer structure, a reference to its corresponding object and a reference to a next object pointer structure, Applicant submits that the discussion at lines 8-45 of column 9 describes a tagging mechanism for tagging bitmap for instantiated object data structures, but the plain meaning of the claim limitation is not attempting to describe a tagging mechanism. Likewise, the description at line 31 of column 12 to line 28 of column 13 fairly and reasonably describes the data structure shown in Figure 3A, but this data structure shown in Figure 3A does not reasonably include "... a reference to a next object pointer structure."

It is suggested that one possible source of the Examiner's confusion is that the "object data structures" in Ungar would appear to be objects, whereas, in the present invention, the "object data structures" are structures that include both an object and another composite pointer.

Therefore, the bitmap used in Ungar and the technique associated with this bitmap does not teach or suggest the present invention, as described by the claims. Ungar performs exact garbage collection using bitmaps that identify pointer values within objects (see title of Ungar). Exact and conservative scans of the heap are described at lines 37-54 of column 3.

Prior art methods of exact scans mark each object in the heap, using tags (e.g., see column 4 line 65 to column 6 line 7), and Ungar uses a bitmap to mark each object in the heap. Ungar uses the bitmap to determine the root set of objects and garbage-collects the entire heap by figuring out the best way to garbage-collect each object. Ungar does not use a conservative scan nor use a stack to determine a root set of objects.

In contrast, the present invention performs a conservative scan of objects in the heap, based on a root set of object pointers found in the thread stack. The object pointers in the thread stack are located easily amongst all the other data in the stack because they are uniquely structured themselves to contain pointers to each other in addition to their respective

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objects. The claims clearly describe that the object pointer structures reference each other. Ungar clearly fails to incorporate this feature.

Therefore, whatever similarities the Examiner perceives between Ungar and the invention described in claim 38, there is clearly no correspondence to the plain meaning of the first two claim limitations of this claim, as explained above. If the Examiner persists in maintaining the rejection based on Ungar, Applicant respectfully requests that she point out very specifically which words in these lines are being interpreted as satisfying the first two claim limitations in claim 38.

Hence, turning to the clear language of the claim, in Ungar there is no teaching or suggestion of: "... said memory having objects, said objects having object pointer structures references in a thread stack, said method comprising: retrieving an object pointer structure from the thread stack; extracting, from the object pointer structure, a reference to its corresponding object and a reference to a next object pointer structure in the thread stack", as required by claim 38.

For the reasons stated above, the claimed invention is fully patentable over the cited references.

Further, the other prior art of record has been reviewed, but it too, even in combination with Ungar or Wilson, fails to teach or suggest the claimed invention.

III. FORMAL MATTERS AND CONCLUSION

In view of the foregoing, Applicant submits that claims 31, 32, and 38-42 all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

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The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Assigness's Deposit Account No. 50-0510.

Respectfully Submitted,

Date: 8/20/04

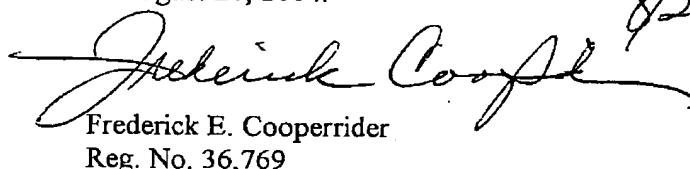


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CERTIFICATION OF TRANSMISSION

I certify that I transmitted via facsimile to (703) 872-9306 this Request for Reconsideration under 37 CFR §1.111 to Examiner T. Pardo on August 20, 2004.



8/20/04

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